producer when the element is originally recorded, such as the advertising agency, production facility or record producer.

RECEPTION PROCESS

The "interactive" data is intended for reception either by those receivers having audio output ports, an auxiliary data output (RDS) port or receivers specially designed for interactive service. The receiver data processing unit or RDPU may be built into the radio set receiver, a fixed or mobile handset, or may be placed in a separate module interfaced to the receiver and the communications device.

The RDPU monitors the audio and, if used, data channels of the broadcast station being received. If the signal code indicating active data transmission is present on the data channel, that channel will be the source of interactive data. If no such signal is present, the program audio will be monitored.

In addition, the RDPU device will provide both radio stations and advertisers rating, polling and survey services. The rating service will, for example, identify consenting listeners of any given radio station at any given point in time, providing valuable demographic and marketing information on such listeners from the central database of subscriber information.

The RDPU stores any data received in its memory. Successive data bursts are compared as part of the error detection/correction process. The date and time of reception are also stored. If data elements are missing, the RDPU substitutes default elements, programmed into its memory at the time service is started, or as later chosen by the consumer.

Missing data elements subject to substitution by the RDPU may include:

1) the local distribution channel code;
2) the local broadcast station identification code;
3) the local response telephone number.

The missing broadcast station identification code can be replaced by the frequency to which the receiver is tuned.

As discussed above, the subscriber may interact through using Grand Broadcasting's proposed interactive radio service with the

radio station program material, advertisements and songs by making any one of two choices, using dedicated push buttons on the RDPU. The received permissible response code illuminates signal lights on the RDPU to inform the consumer which of the two response options are active:

1) buy the product/service being advertised or record/CD of song being aired; affirmative response to voice/data query from radio station;
2) request additional information.

In each case the RDPU will send the data necessary to dial the local system access number via communications device, sending a data burst to complete the ordering transaction. When no connection can be or is made, the data will be stored in memory while the RDPU periodically re-dials until a connection is established.

RESPONSE DATA

The RDPU transmits the consumer's response to the local system access telephone number via a fixed or mobile interactive radio frequency communications device. Upon establishment of a reliable connection, the following data is sent from the RDPU to the system host computer:

1) the product/service/programming element identification code;
2) the local distribution channel code;
3) the local broadcast station identification code;
4) the date and time of reception/selection;
5) the user's identification code;
6) the mode of the consumer's response;
7) a checksum code for error detection.

Several duplicate transmissions may be sent for error checking and correction. When the ordering transaction is complete, the host computer sends a confirmation code to the consumer via the communications link.

An interactive request for information or response may be instituted by the radio listener, radio station or merchant. A

menu query system for multiple layers of interactive inquiry and responses will be available.

IBRS EXPERIMENTATION

Pursuant to FCC Special Temporary Authorization, Grand Broadcasting Corporation is presently conducting experimentation of the proposed Radio Order IBRS service. The FCC authorization is to use the 940.5-941 megahertz band for IBRS. Grand Broadcasting recently filed with the Commission an initial report on this on-going experimentation. Copies of this report are provided today as handouts.

As stated at page 1 of the report, the radio station data transmission method used in the test was the embedded method, transmitting the data through embedding or mixing the codes into the audio broadcast. This embedded method is preferred over the subcarrier transmission method because it allows AM radio stations to participate in IBRS and it is much more convenient for advertising agencies, production houses, record labels and radio stations to participate in IBRS - only requiring mixing the codes into the original recording.

The overriding objective of this initial test was to determine the feasibility of transmitting and recovering or decoding a coded message in the audio of an FM radio broadcast. The total length of the message mixed into the FM audio is 43 characters or 344 bits. This data includes all of the codes listed above to be embedded into the audio.

The modulation technique chosen for this initial experiment is phase shift keying of an audio carrier tone. The carrier frequency is 400 hertz. The modulation rate is 200 bits per second, with a transmission time of 1.75 seconds.

I have taped this message broadcast, the taping begins with the end of one commercial and the code is mixed in the beginning of a commercial for Ventures Nightclub. Mark, please play the tape.

Successful recovery and decoding of this coded message is reflected in the figures contained in the handout. Figure 3 shows the original recording of the message. The coding of the message

is quite evident in the expanded view of the signal shown in Figure 4. Figure 5 shows the message as received from KKMG-FM, the participating station. Figure 6, however, demonstrates difficulty in picking out the bits of the message from the remaining sounds in the commercial.

To recover the data from the signal, the following procedure was used:

1) the signals were shifted to have amplitudes of about +/- 1 volt;
2) the number of data points were reduced to only a few more than the total length of the message;
3) the signal was cross-correlated with the one and the zero bit data series shown in Figures 1 and 2, thereby filtering the signal at just the 400 hertz frequency;
4) the cross-correlation output for the signals were then multiplied together on a point by point basis; and
5) the product of step 4 was then clipped at two levels to produce the results shown in Figures 7 and 8.

Actual recovery of encoded data can be seen in Figures 7 and 8. Thus, this initial experiment demonstrated that transmitting, recovering and decoding an encoded message in the audio of an FM signal is feasible.

The experiment also uncovered two areas for refinement in the next stage of testing:

1) notch filtering the commercial material around the message carrier frequency to make the message virtually inaudible; and
2) incorporating a real time version of the demodulator to improve the DSP algorithms.

The second and final stage of this STA experimentation is to time multiplex the embedded data broadcast onto the authorized 940.5-941 megahertz band.

CONCLUSION

The success of Grand Broadcasting's initial experiment underscores the need for the FCC to allocate IBRS spectrum now, in General Docket Number 90-314 as requested. Indeed, the

feasibility of allowing FM and AM radio stations alike to participate in interactive broadcast data transmission has been demonstrated.

All that is lacking is the one megahertz allocation for two IBRS service providers per market - to connect radio broadcasters to the emerging digital, interactive and multimedia marketplace. In conclusion, IBRS will allow radio broadcasters to utilize their inherent data transmission capacity, as Chairman Quello suggested in his opening luncheon address.